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RECLINE MECHANISM FOR SEATING FURNITURE**TECHNICAL FIELD**

This invention relates to furniture and in particular though not solely to a recline
5 mechanism for use in seats or chairs which allows for tilt adjustment of the
seatback and/or base of the seat or chair.

BACKGROUND ART

Seating furniture such as chairs, seats or even sofas may be of a fixed design
wherein the base of the seat (hereinafter referred to as the seat base, base or
10 simply seat) is substantially immovable (although it may include a cushion) but is
not tiltable with respect to the frame of the item of furniture. Equally, in a fixed
frame item of seating furniture the seatback of the chair is also substantially
immovable and therefore the item of furniture is not readily adjustable to a user's
changing seating position. Accordingly, after long periods of use in such a fixed
15 item of seating furniture a user often becomes uncomfortable and/or develops an
altered seating position which is unsupported by the structure of the seating
furniture and which may ultimately lead to posture problems or, for example,
backache.

Seating furniture may also come in an adjustable variety whereby the seat and/or
20 back of the chair is adjustable with respect to the frame of the chair in order to
adapt to a user's posture or seating position. For example, many office chairs
include a number of user alterable features including seat and seatback angle
adjustment. Usually a complicated mechanism is provided for locking the seat
and/or seatback in position once a suitable angle has been attained by the user. A

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spring or an alternative biasing mechanism is usually required in order to provide resistance to the movement of the seat and/or back over their range of movement so that the user does not completely lose support during the adjustment process.

Accordingly, existing mechanisms for adjusting the seat and/or back of items of seating furniture are relatively complex and therefore expensive to manufacture and purchase. It would be an advantage to provide a recline mechanism for an item of seating furniture which was less complicated and simpler to manufacture and therefore could be incorporated into seating furniture at the less expensive end of the market to provide users of those seats with improved comfort and support whilst seated.

It is therefore an object of the present invention to go at least some way towards overcoming the above disadvantages or addressing the above problems or to at least provide the public with a useful choice.

All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinence of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the

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listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

5 DISCLOSURE OF INVENTION

In one aspect, the invention may broadly be said to consist in seating furniture including:

- a frame,
- at least one support member adapted to provide support to a user in use,
- 10 • a recline mechanism connecting the support member to the frame, the recline mechanism including;
 - a housing positioned on one of either the support member or the frame and
 - an extending portion of the frame positioned on the other of either
 - 15 the support member or the frame, said housing receiving the extending portion within a cavity bounded by a cavity wall; and
 - biasing means located inside the cavity between at least a portion of the cavity wall and the extending portion,

wherein tilting movement of the support member causes a rotation between the

20 cavity and the extending portion thereby engaging the extending portion with the biasing means, causing said biasing means to generate a restorative biasing force against the rotation.

Although the housing/cavity and extending portion may be respectively positioned on the support member and frame or vice versa, the present invention is described herein with reference to the housing being positioned on the support member for sake of clarity and readability. It will be appreciated this is purely exemplary, and
5 the invention is not restricted to this configuration.

Preferably, the extending portion of the frame is fixed relative to at least a portion of the frame to which the support member is connected.

According to one aspect, the biasing means comprises an elastic material, preferably an elastically compressible or extensible material.

10 Similarly, it will also be readily understood that said biasing means may be configured to apply a restorative reaction force to the effects of extension or compression. The extending portion may for example may be at least partially enveloped by, or fixed to, the biasing means which in turn is fixed to the cavity wall. Thus, any rotation of extending portion would cause an extension of the biasing
15 means and thereby generate a reactionary restorative biasing force against the rotation.

The invention is henceforth described with reference to a compressible biasing means, though again this is for exemplarily purposes only and does not exclude the invention from utilising extensible biasing means. Preferably, the biasing
20 means is cylindrical or tubular in shape.

In a further aspect, the invention may broadly be said to consist in seating furniture including:

- a frame,
- at least one support member adapted to provide support to a user in use,

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- a recline mechanism connecting the support member to the frame, the recline mechanism including

- a housing positioned on the support member and having a cavity which receives an extending portion of the frame, and
- 5 - biasing means mounted between the wall of the cavity and the extending portion,

wherein the biasing means comprises a unitary elastically compressible material, and

wherein tilting movement of the support member causes the cavity to translate
10 about the extending portion while the compressive state of the biasing means adjusts in response thereto. Preferably, the extending portion of the frame is plate-like in shape and biasing means are located between at least one side of the extending portion and the cavity wall.

Alternatively, at least an end portion of the extending portion of the frame is rod-
15 like in shape and the biasing means is positioned about the extending portion.

Preferably, the cavity in the housing is substantially triangular in cross-section.

Alternatively, the cavity in the housing has a centrally-waisted configuration in cross-section, i.e. two opposing triangular portions joined at a common apex in a substantially "bow-tie" shape.

20 Preferably, the plate-like extending portion extends longitudinally into the centrally-waisted cavity and is pivotable laterally about a central pivot point of the cavity.

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Alternatively, the rod-like extending portion extends laterally into the centrally-waisted cavity and is pivotable longitudinally about a central pivot point of the cavity.

Preferably, biasing means are provided about both ends of the rod-like shaped end
5 portion of the extending portion of the frame.

Preferably, said housing is integral with said support member.

Alternatively, said housing is connectable to said support member.

Alternatively, said housing comprises a first section integrally formed with the support member and a second section connectable to the first section wherein the
10 cavity is formed between the first and second sections.

Preferably, said support member includes a seat.

Alternatively, said support member includes a seatback.

Preferably, the support member is provided with stopper means adapted to contact the frame.

15 Alternatively, the frame is provided with stopper means against which the support member comes into contact.

Preferably, said biasing means is formed from elastomeric material or natural rubber.

Preferably, the biasing force provided by the biasing means is adjustable by
20 altering the length of the elastomeric or natural rubber material within the cavity.

Alternatively, the biasing force provided by the biasing means is adjustable by altering the density of the elastomeric or natural rubber material within the cavity.

BRIEF DESCRIPTION OF DRAWINGS

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

- 5 Figures 1A to 1C are a series of side-elevational views of a chair incorporating a recline mechanism according to the present invention being utilised by a user in various seating positions;
- Figure 2 is a side-elevational view of the seat base of the seat shown in Figures 1A to 1C;
- 10 Figures 3A to 3C are a series of cross-sectional side-elevational views of the recline mechanism shown in Figure 2 in different positions with the seat base removed for clarity;
- Figure 4 is a side-elevational view of the seatback of the seat shown in Figures 1A to 1C; and
- 15 Figures 5A to 5C are a series of cross-sectional side-elevational views of the recline mechanism shown in Figure 4 in different positions with the seat back removed for clarity.
- Figure 6A shows a perspective view of a second embodiment of a chair according to the present invention;
- 20 Figure 6B shows a side elevation of the chair shown in figure 6A;
- Figure 6C shows an underside plan view of the chair shown in figure 6A;

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- Figure 6D shows a rear side elevation view of the chair shown in figure 6A;
- Figure 6E shows a front side elevation view of the chair shown in figure 6A;
- 5 Figure 7A shows a perspective view of second embodiment of a chair according to the present invention;
- Figure 7B shows a side elevation of the chair shown in figure 7A;
- Figure 7C shows an underside plan view of the chair shown in figure 7A;
- 10 Figure 7D shows a rear side elevation view of the chair shown in figure 7A;
- Figure 7E shows a front side elevation view of the chair shown in figure 7A;

BEST MODES FOR CARRYING OUT THE INVENTION

- 15 With reference to the drawings and in particular Figures 1A, 1B and 1C a chair or seat 1 in accordance with the present invention is shown in use by a user in three distinct positions. The chair includes support members which provide support to a user in use. The support members include a seatback 2 and a seat or seat base 3.
- Figure 1A shows the user reclining so that the seatback 2 is tilted backwards and
- 20 the front edge of seat 3 is tilted downwards. In Figure 1B the seat is in a "neutral" position wherein the user's torso is substantially vertical so that the seatback 2 is also substantially vertical and the seat 3 is substantially horizontal. In Figure 1C the user is leaning slightly forward so that the seatback 2 is not substantially

contacting the user and is in a similar position to that shown in Figure 1B whereas the seat 3 is tilted forward in a similar manner to that shown in Figure 1A.

Accordingly, the series of drawings in Figures 1A to 1C show the range of movement of the seatback 2 and seat 3 of the chair incorporating a recline mechanism 4 in accordance with a preferred embodiment of the present invention. It should be noted that the recline mechanism 4 could be associated with either the seatback 2 or the seat 3 or alternatively, as shown, both the seatback 2 and the seat 3 could have associated recline mechanisms 4. Furthermore, although the invention will be described with reference to a standard four legged chair it should be understood that the invention could equally be utilised in, for example, an office chair, sofa, stool, bench, or even in lounging furniture such as a sofa.

Seat 1 includes a frame including a seatback supporting portion 5, a seat base supporting portion 6 and legs 7. The frame may for example be constructed from metal such as solid or hollow tubular steel, from wood or even from a suitably sturdy plastics material.

With reference now to Figure 2, the construction and operation of the recline mechanism 4 associated with the seat base 3 will be described.

Seat base 3 may be constructed from a suitably flexible plastics material such as polypropylene and contoured to receive a user's buttocks and upper thighs. The seat could also be formed from wood such as plywood or metal, both of which may also be suitably (but more permanently) deformed to a user's body shape.

In the example shown in Figure 2 it can be seen that the recline mechanism 4 comprises two parts, a first section 8 and a second section 9. The first section 8 is formed integrally with the seat base 3 while second section 9 is separately formed and adapted to be coupled or attached to the first section 8. However, the recline

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mechanism 4 could be formed from a unitary component which is adapted to be attached to the seat base 3 or could alternatively be totally integral with the seat base 3. Alternatively, the recline mechanism 4 could be formed from an aluminium extrusion or from pressed or cast steel which may then be moulded within a
5 plastics seat base 3.

Figures 3A to 3C show in detail the operation of the recline mechanism associated with seat base 3. In Figure 3A the front edge of the seat base 3 has been tilted downwards, similar to the position shown in Figures 1A and 1C. In Figure 3B the seat base 3 is in a static position without a user in the seat. In Figure 3C the seat
10 base 3 is in a position similar to that shown in Figure 1B with the user sitting normally.

It can be seen in Figure 2 and in Figures 3A to 3C that the recline mechanism 4 comprises a housing including a cavity 10. An extending portion 11 of the seat supporting part of the frame is received within cavity 10. Extending portion 11 is
15 substantially immovable with respect to the frame and so is fixed in position irrespective of the user's sitting position and the position of the seat base. In contrast, the housing of the recline mechanism 4 is attached to or integrally formed with the seat base 3 and therefore moves with seat base 3 so that cavity 10 effectively translates about extending part 11 during tilting movement of seat base
20 3. It will be appreciated that once the extending portion 11 is captive within cavity 10, the seat base is effectively connected to the frame.

The extending part 11 could comprise a flat plate extending substantially horizontally and laterally beneath the seat base 3. The housing of the recline mechanism 4 could extend laterally substantially the whole width of seat base 3 or
25 could extend only a portion of the width of the seat base 3. Alternatively, a plurality of separate housings could be aligned across the width of the underside of seat

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base 3 through each of which the extending part 11 extends. Extending part 11 could alternatively comprise a "T" or "I" shaped rod extending laterally beneath seat base 3 and including perpendicularly attached end parts, one of which is shown in Figures 3A to 3C and which comprises a short length of, for example, steel rod. It will be appreciated that extending part 11 could in fact be any shape capable of transferring rotational movement between the frame and the housing. Accordingly, the extending part could have a square, rectangular, hexagonal, oval or other non-circular cross-section and could be solid or hollow.

Biassing means 12 are also provided within cavity 10 between the walls of the cavity and the extending part 11 of the frame. The shape of cavity 10 in Figures 3A to 3C is a centrally waisted shape akin to a "bow-tie" shape and the extending part 11 pivots about the central region 13 of cavity 10 (although, as mentioned above, it is the cavity which moves or translates about the extending part). The cavity therefore includes two substantially triangular shaped lobes joined at a pivot point at their apexes and the biasing means 12 cushions the motion of the extending part 11 as it moves between the sidewalls of the cavity in response to tilting forward and backward of the seat base 3.

Biassing means 12 is a unitary elastically compressible material such as an elastomer or natural rubber. The biasing means 12 in Figures 3A to 3C could comprise four separate portions of elastomeric material, one on either side of the extending portion in each of the lobes forming the cavity. The biasing means 12 could be solid or hollow and could be, for example wedge shaped to substantially match the shape of each half-lobe. The flat plate forming the extending portion 11 would therefore extend longitudinally through the cavity 10 which pivots laterally about the pivot point.

Alternatively, the biasing means 12 could be formed in a tubular shape which is

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easily slipped over the end of a rod comprising the end portion of extending portion 11. Accordingly, as shown in Figures 3A to 3C the biasing means 12 may comprise two tubular sections of elastomeric material, each one positioned over a respective end of a rod forming the end part of the extending portion 11. in this case, the rod forming the extending portion would extend laterally into the cavity and pivot longitudinally about the pivot point of the cavity.

Biasing means 12 acts to cushion the movement of the extending part as the user tilts the seat base forward and backward of its static position. The biasing means also provides a restorative force to assist in returning the seat base to its static or neutral position as it decompresses.

The configuration and operation of the recline mechanism 4 in relation to the seatback 2 will now be described with reference to Figure 4 and Figures 5A to 5C.

Seatback 2 includes supporting surface 14 against which the user's back rests in use. The backside of seatback 2 includes a recline mechanism 4 which, as previously described with reference to the seat base 3, comprises a housing including a cavity 10. The housing could be a two part housing as shown in Figure 4 with first 8 and second 9 sections or could be a unitary housing attached to or integral with seatback 2. As with the seat base, the seatback 2 could be formed from a plastics material such as polypropylene or alternatively from wood such as plywood or even from metal such as aluminium or steel. As also mentioned previously, the recline mechanism 4 could be formed as an aluminium extrusion or from pressed or cast steel that could then be integrally moulded into a plastics seatback 2.

The housing of the recline mechanism 4 could extend laterally across the entire width of the seatback 2 or could extend only a portion of the width of the seatback.

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A plurality of separate housings could be spaced across the width of the seatback with their cavities 10 aligned with one another. An extending part 11 of the frame of the seat extends through the cavity (or cavities) formed in the housing and a biasing means 12 is provided between the wall of the cavity and extending portion 11 of the frame. It can be seen in Figure 4 that the biasing means 12 is preferably tubular and is formed from an elastomeric material or natural rubber but could equally be formed without a central opening or could be formed in a different shape such as a wedge shape. However, it has been found that the tubular shape shown in Figure 4 does provide satisfactory results in the present invention.

10 It can also be seen in Figure 4 that the shape of cavity 10 is substantially triangular and it will be appreciated that, unlike the seat base 3, the static or userless position of seatback 2 is at one extreme end of the range of movement of the seatback 2 (in contrast, the static position of seat base 3 is between the two extreme ends of the range of movement of the seat base 3). Accordingly, Figure 5A (and Figure 4) shows the static position of the seat base 3 when there is no user in the seat. Figure 5B shows the position of the housing and therefore the seatback when the user is in a normal seating position (that is, slightly reclined) and Figure 5C shows the position of the housing and therefore the seatback in a substantially fully reclined position.

20 The extending portion 11 of the frame may comprise a plate extending laterally from the seat back supporting part 4 of the frame which is rigidly connected to the frame so that it does not move although the housing of the recline mechanism 4 translates about it. It can be seen from the series of drawings in Figures 5A to 5C that as the user reclines the seatback 2 further, the volume of the portion of the cavity 10 in which the biasing means 12 is positioned is reduced and therefore the compressive state of the biasing means is altered. Accordingly, during the

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complete range of movement of the seatback 2 the biasing means will provide some resistance to that movement or, in the case of the seatback moving from a reclined position towards its static position then the biasing means will assist in restoring the seatback's position as it decompresses.

- 5 In order to adjust the amount of bias which the biasing means provides to the support member 2,3, the length of tube positioned within cavity 10 may be adjusted so that a longer tube will of course increase the resistance and restorative force provided by the biasing means 12 and a shorter length of tube would reduce the amount of resistance and restorative force provided. Although the ultimate limit of
10 tilting movement of the seatback and base may simply be governed by the compressive limit of the biasing means and the shape of the cavity 10, stoppers may be provided on the frame to contact with the seatback and/or seat base, halting further motion prior to the biasing means reaching its compressibility limit thereby avoiding premature damage to the biasing means. Alternatively, the
15 support member 2,3 could be provided with a stopper or stoppers positioned so as to contact the frame during movement.

Figures 6A-6F show a further embodiment of the present invention where like components in common with the previously described embodiments are like numbered. In the embodiment shown in figure 6, the seat base supporting portion 6
20 and a pair of legs 7 on each side of the chair 1 are formed from a single continuous tube bent into an 'n' shape. The seat 3 is mounted slightly higher above the seat base supporting portion 6 than in the previous embodiment to reduce the possibility of a user trapping and possibly injuring fingers between the frame and seat 3 during tilting. Stoppers 15 are also positioned on the seat base supporting portion
25 6 either side of the recline mechanism 4 to limit the maximum extent of seat 3 tilt.

The embodiment in Figures 7A-7F shows a further variant of the embodiment of

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Figures 1-6. Unlike the conventional four legged configuration utilised in the embodiments in Figures 1-6, the embodiment shown in Figure 7A-7F utilises a skid-leg configuration. This configuration replaces the four conventional legs located at the corners of a typical seat with a pair of 'C' shape frames 27 on
5 opposing sides of the chair 1. The fore leg 7 is replaced by a floor contacting portion 16 forming the lower side of the C-shaped legs 27 connected to an upright rearward leg portion 17 in turn connected to a seat base supporting section 18 orientated substantially parallel to the floor contacting portion 16. In addition to providing extra leg room at the chair front, the C-shaped leg configuration enables
10 multiple chairs 1 to be nested without the need to completely pick up a chair before stacking it over another chair. This can be particularly useful in schools and the like.

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto
15 without departing from the scope thereof.